Liquid-bearing cloud visible OD correspondence with LW opacity

\[ R = 0.92, p_{val} = 0.00, \text{ fit: } HSLR = 0.13608 \text{LWP} + 0.29788 \]
Liquid and Ice Water Paths Comparisons – ERA-5

- Observed liquid & no model liquid – 61%
- Model liquid & no observed liquid – 56%
- No correlation
- Observed ice & no model ice – 24%
- Model ice & no observed ice – 27%
- Reasonable correlation, mainly at higher IWP

Silber et al., J. Clim., submitted
Liquid and Ice Water Paths Comparisons – AMPS

Observed liquid & no model liquid – 99.5%
Model liquid & no observed liquid – 35%
Not many data points to correlate...

Observed ice & no model ice – 15%
Model ice & no observed ice – 25%
Weak correlation at higher IWP values

Silber et al., J. Clim., submitted
Resolved Cloud Mask

• Hourly cloud masks are generated using the observations from the AWARE campaign.
• Cloud occurrence time series is derived from the resolved cloud masks.

We will examine the model performance in three different cloud regimes:
1. Tenuous liquid-bearing (mixed-phase) clouds (LWP < 25 g/m²).
2. Opaque liquid-bearing (mixed-phase) clouds (LWP ≥ 25 g/m²).
3. Ice clouds.

Silber et al., JGR, 2018
WAIS Divide

(e) $y = -0.19x + 0.24$, $r = -0.98$

(f) $y = 0.23x + 0.19$, $r = 0.28$

Silber et al., J. Clim., in revision
Sounding comparison

(a1) AMPS T [K] vs Altitude [km]

(a2) AMPS q [g/kg] vs Altitude [km]

(a3) AMPS RH [%] vs Altitude [km]

(b1) ERA5 T [K] vs Altitude [km]

(b2) ERA5 q [g/kg] vs Altitude [km]

(b3) ERA5 RH [%] vs Altitude [km]
Modeled vs. Observed LW Radiation

![Graph showing modeled vs. observed LW radiation over the month of 2016. The graph compares observed data with modeled data from ERA5.]
Lack of the Opaque Regimes in the Models

McMurdo Station

Radiatively clear

Radiatively opaque
Cloudy vs. Clear-sky LW radiation

Separation

McMurdo Station

Radiatively clear
Seasonal Behavior
Modeled LW↓ Bias

Note: on an annual perspective, the models do provide a reasonable performance!
Modeled vs. Observed Downwelling LW

LW_{down} detrended, \( R = 0.74 \)

LW_{down}', \( R = 0.82 \)
Modeled vs. Observed Downwelling SW